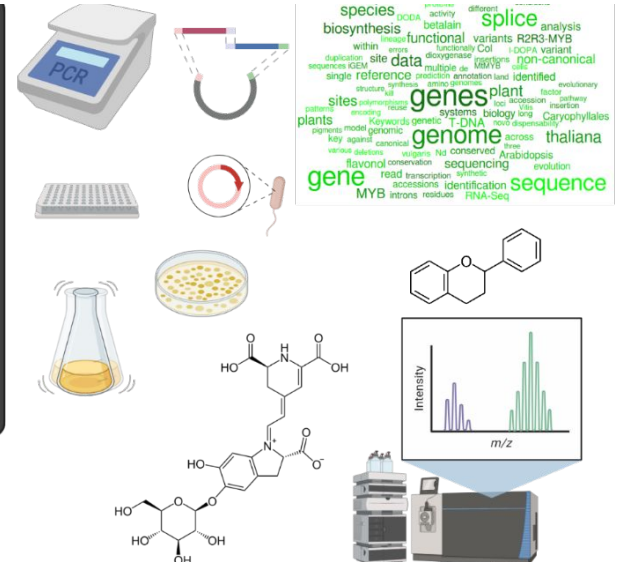
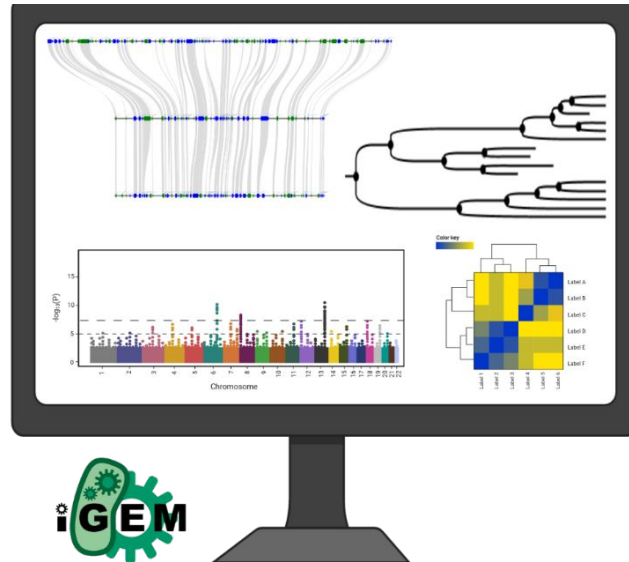




Technische
Universität
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Python - Getting started

Prof. Dr. Boas Pucker (Plant Biotechnology and Bioinformatics)

Availability of slides

- All materials are freely available (CC BY) - after the lectures:
 - StudIP: 'Python for Life Scientists'
 - GitHub: <https://github.com/bpucker/teaching>
- Questions: Feel free to ask at any time
- Feedback, comments, or questions: [b.pucker\[a\]tu-bs.de](mailto:b.pucker[a]tu-bs.de)

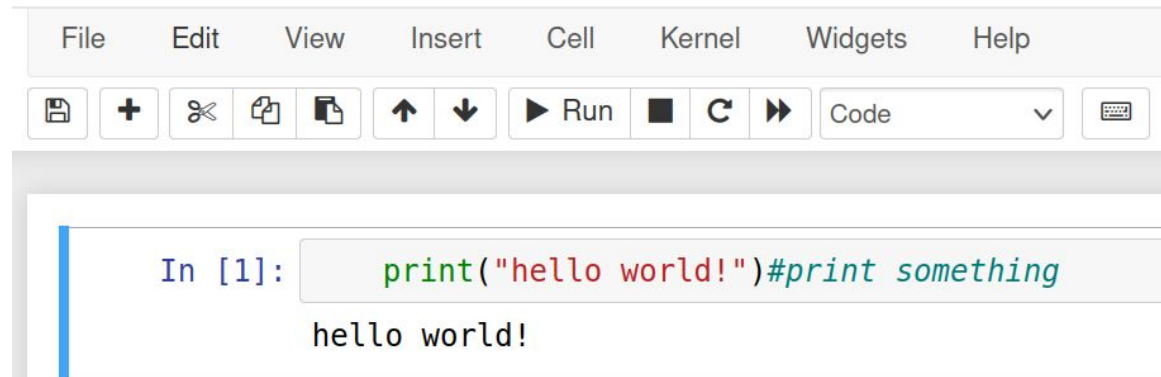
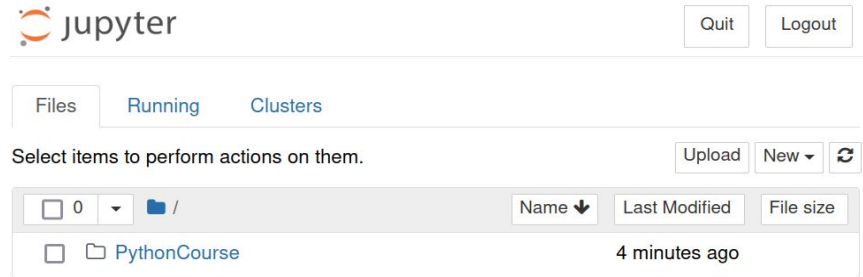
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Installing Jupyter Notebook

- Linux:
 - `$ sudo apt update`
 - `$ sudo apt install python3-pip python3-dev`
 - `$ mkdir python_course`
 - `$ cd python_course`
 - `$ virtualenv python_course`
 - `$ source python_course/bin/activate`
 - `$ pip install jupyter`
 - `$ jupyter notebook`
- Windows:
 - 1) Install Anaconda
(<https://www.geeksforgeeks.org/how-to-install-anaconda-on-windows/>)
 - 2) Install Python3 through Anaconda
 - 3) Install Jupyter through Anaconda
(<https://www.geeksforgeeks.org/how-to-install-jupyter-notebook-in-windows/>)
- Mac:
 - See instructions above

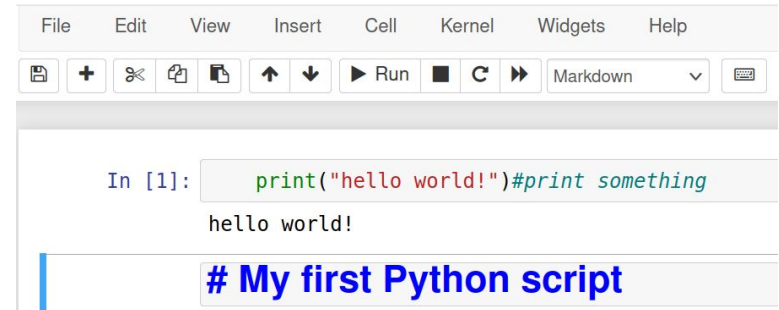
Starting Jupyter Notebook

- Start Jupyter Notebook
- Create a new file:
 - 'New'
 - Python3 ipykernel
 - Change name
- Python code is written and executed in Jupyter Notebook

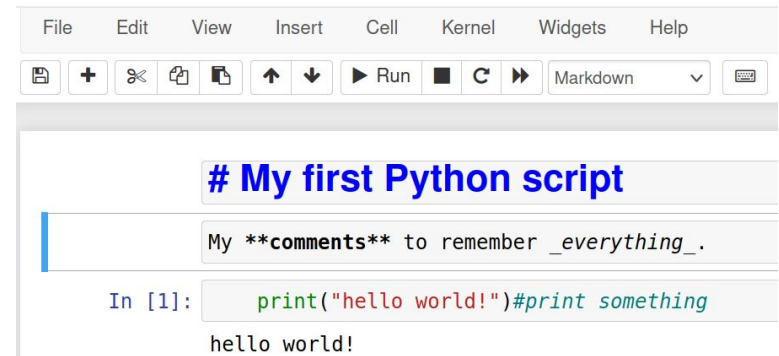


Adding elements to a Jupyter Notebook

- Code: you know this already
- Header: structure your work/documentation
- Markdown: comments with specific formatting



The screenshot shows a Jupyter Notebook interface with a menu bar (File, Edit, View, Insert, Cell, Kernel, Widgets, Help) and a toolbar. The main area contains two cells. The first cell is a code cell with the prompt 'In [1]:' followed by the code `print("hello world!")#print something` and the output 'hello world!'. The second cell is a header cell with a blue title **# My first Python script**.



The screenshot shows a Jupyter Notebook interface with a menu bar (File, Edit, View, Insert, Cell, Kernel, Widgets, Help) and a toolbar. The main area contains three cells. The first cell is a header cell with a blue title **# My first Python script**. The second cell is a text cell containing the text 'My ****comments**** to remember `_everything_`.'. The third cell is a code cell with the prompt 'In [1]:' followed by the code `print("hello world!")#print something` and the output 'hello world!'. The code cell is selected, indicated by a blue vertical bar on the left.

Simple commands & variable types

- `print()` allows you to show the results of calculations in the terminal
- Different types of variables can be stored in a list
- Different types of number (int or float)

```
print("test") #print
my_list = ["1", "2", "3", 4, 5, 6] #list
my_int = 1 #int
my_float = float(3.1) #float
my_string = str(my_int) #string
```

Comments and structure

- Two ways to add comments:
- '#' rest of the line is comment and ignored by Python
- Triple quotation marks allow comments over multiple lines
- Use ASCII characters only (**no** ä, ö, ü, ß, ...)
- Empty lines are ignored by Python (use space to structure code)

Assignment and comparison

- '=' used to assign value to variable
- '==' compares two values/variables
- Variable names may contain characters, underline, and numbers (not at the start)

```
In [4]: a = 'hello world!'  
        print(a)
```

hello world!

```
In [5]: b = 'test'  
        c = 'test'  
        a == b
```

Out[5]: False

```
In [6]: b == c
```

Out[6]: True

Variable type: string

- a, b, c are strings ('str')
- Python allows to check the variable type:
 - `type(a)`
- Almost all variable types can be converted to string:
 - `str(<VARIABLE>)`

Variable types: integer & float

- Two variable types for numbers
 - Integer = complete number (example: 3)
 - Float = decimal number (example: 3.1415926)
- Important: '.' NOT ',' separates numbers in float
- Some strings can be converted to integer/float
 - `My_int = int('3')`
 - `My_float = float('3.145926')`
- Check result via `type(<VARIABLE>)`

Python as calculator

- Numbers can be used for calculations
 - `a = 3`
 - `b = 2`
 - `print(a+b)`
 - `print(a*b)`
 - `print(a/b)`
 - `print(a/float(b))`
 - `print(a%b)`
 - `print(a<b)`
 - `print(a!=b)`
- How to calculate roots?
- Interested in more complex math? (NumPy, SciPy)

Variable type: list

- List can contain elements of different types (e.g. strings)
- Elements can be accessed via index
- Index is given in square brackets after the list name:
- Matching your expectation?

```
my_list = ["one", "two", "three"]  
print(my_list[1])
```

Indices in Python

- Python starts counting at 0!!!

```
my_list = ["one", "two", "three"]  
#           0       1       2
```

- Lists can be concatenated

```
new_list = new_list + ["four", "five", "six", "seven"]  
#new_list = ["one", "two", "three", "four", "five", "six", "seven"]  
#           0       1       2       3       4       5       6
```

- Print subset of list

```
print(new_list[3:])  
print(new_list[:3])  
print(new_list[3:5])
```

- Two indices: index1=first element to include; index2=first element following the selection

Indices in Python II

- Strings have indices as well
- -1 points to the last element of a string/list
- -5 points to the 5th element from the end of a string/list

```
a = 'hello world test string!'
print(a[1:])
print(a[5:10])
print(a[:-1])
print(a[-5:-1])
```

Variable type: boolean (True/False)

- Already used for comparison:

```
print(1==1)
print(1>1)
print(1==True)
print(True+True)
print(True+False)
```

- Boolean variables can be used for calculations (like numbers)
- Most of the time used only for internal calculations

Brackets

- Two important types of brackets
 - '[' to generate lists and to access elements via index
 - '(' to transfer arguments to functions

```
a = []  
b = "test"  
print(b[1])
```

- What are functions?
 - Examples:

```
x = 3.145  
str(x)  
int(x)  
float(x)
```


Exercises - Part1

- 1.1) Save 3,14159265359 in a variable of type float!
- 1.2) Convert variable from float to integer!
- 1.3) Convert variable back! What happens?
- 1.4) Convert variable to type string!
- 1.5) Save 'Python' in a string variable!
- 1.6) Convert variable type to float! What happens?
- 1.7) What is a pitfall in regard to division when working with int/float?

Time for questions!